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MORE ABOUT COAL

THE winter comes on apace. Our coal stores, if not exactly empty, are in a dangerously bare condition. The Gas Industry is short of coal; the electricity industry is short of coal; the industries of the country will be short of coal—their stocks are equally insufficient; during this coming winter, the domestic consumer is likely to shiver round his inadequate hearth. Has he an electric fire? It may have to be turned off through shortage of current. Has he a gas fire? He may find the gas pressure insufficient to cause more than a tantalizing, tentative glow. Has he a solid fuel grate? He may find little or no fuel to put in it. Would he eat to keep himself warm? His bread is rationed.

As a public utility, threatened by nationalization, the Gas Industry is seriously disquieted regarding its inability to supply the heat that the public quite rightly demands from it this coming winter. The shortage of fuel will affect every individual in one way or another. Perhaps the greatest tragedy of all may be that factories will be forced to close or to go on short time if fuel is not forthcoming, and that at a time when increased production is the greatest single need of the nation.

The Gas Industry has expanded as the result of the achievements during the war years, and that without any form of canvassing to secure increased load—quite the reverse. Appliances have not been easy to get, consumers had to be refused, every possible means has been adopted both officially and unofficially to persuade industrial and domestic consumers alike to use less gas and electricity. But what has been the result? Here are Mr. Shinwell's words in the House of Commons: "The country is consuming more coal at present than it has ever done. Exports and bunkering needs apart, for inland consumption our estimated requirements this year will amount to 188,000,000 tons—the highest figure known. Public utilities and industry will consume more coal than in any non-war year since 1913. Gas consumption in the present whole year is 23,700,000 tons. *That is the highest in history.* To-day it is running at the rate of 24% higher than in 1938. As regards electricity, the consumption is 26,300,000 tons, which is 2,300,000 tons higher than in 1945 and 76% higher than in 1938." Are we getting very statistical? It is doubtful whether the coal consumption is a proper measure; for it must not be forgotten that, as we have said before, the coal contains far more unburnable matter than ever it has done within living memory. Mr. Macmillan was not far from the truth when he avowed that "for the domestic consumer it was possible to make a crazy pavement in the garden from the coal burnt in the grate. It would be interesting to know how much of the present coal output is shale and dirt additional to the quantities credited to the mines before the war. The Minister has said that from deep mining it is expected to get 177,000,000 tons at the present rate of production. The production of saleable coal in 1938 was some 227 million tons; we should calculate that the 177 million tons expected this year is in truth equivalent to not more than 160 million tons of pre-war quality. The allowance for dirtier coal is one that is never made by Ministerial spokesmen; but it should be widely recognized, for it adds greatly to the difficulties both of industry and of the domestic consumer.

GAS GRIDS AND REGIONALIZATION

IT is still a difficult matter to understand clearly how the Heyworth Committee decided upon what regions to recommend for the future organization of the Gas Industry. Was it a question, to some extent, of drawing a bow at a venture? This question is asked in the light of the Paper on "The Development of a Gas Grid," presented by Messrs. W. Hodkinson and H. B. Taylor at the Institution meeting. There are many ways of looking at gas grids. There is the enthusiastic approach which suggests that since electricity has its grid, bringing current to most parts of the country, gas could and should do likewise. There are those who point with admiration to the Ruhr gas grid, and who ask why a similar grid could not be constructed in England. There are those who are content to build up gas net-works as and when opportunity offers, but who dislike the whole-hearted gas grid. So the tale could continue. Regional gas grids are favoured by many, but there are others who ask with some justification what there is to prevent certain regional mains being joined together, making virtually a national gas grid. Whatever may be the prejudices of the individual, they must give place to appraisement based on calculation and judgment. Questions—often awkward questions—must be answered. Will the grid bring gas to a particular town more cheaply than that town could manufacture it for itself at a works situated in the locality? If not, are there any compensating advantages? What size must the grid main be? Will there be continuity of supplies of gas from which the grid can draw? It must be confessed that gas grid schemes have hitherto been based on the conveyance of gas which is initially cheap at the source of supply, so that the first cost of the gas plus the cost of transmission makes the whole an economic proposition.

In this country and in Germany the basis has been cheap coke oven gas. There is a widespread feeling in the coke oven industry that coke oven gas has never been assessed at the ovens at the price it should command. Gas engineers reply to this that the price they pay for it is that which they can afford to pay; at a higher price it would be preferable to make gas at the gas-works. Into the merits, or de-merits, of this controversy we do not propose to enter at the moment. It would seem, though, that long-distance transmission in this country depends upon the cost of gas at the coke ovens being less than the manufacturing cost at the gas-works plus the cost of transmission. In the U.S.A. natural gas is conveyed for very large distances indeed, and here again, the cost of the natural gas at the wells is small compared with the cost of manufacturing it from coal. What, then, would be the economics of regional gas grids based on gas at normal manufacturing costs?

The first thing that emerges from Messrs. Hodkinson and Taylor's Paper is the care which must be taken in making

a survey before deciding that a long distance gas main should be laid. "Before any pipe is laid, the area to be ultimately developed should be determined, with all that this entails in assessing the potential loads to be provided for, the possible sources of coke oven gas, the best and most economic sites for major manufacturing stations, and the economics of bulk distribution. Once these points have been settled, all mainlaying and plant reconstruction could be carried out to a rational plan, each piece fitting together as in a jig-saw puzzle until ultimately the last pipe is laid and the last works is shut down." Each area must be considered in detail and on its own merits, a point to which the Authors of the Paper attach the greatest importance. There is no easy way to determine the economic limits of a grid system, the only proper course being to develop each scheme in detail with consequent expenditure of time and labour. Regionalization, in our view, requires equal thought. It may be that each region should be co-terminus with the areas within which gas grids could be visualized—or it may not. But any scheme for regionalization demands a careful consideration of this and many other factors.

A second important detail in the success of a gas grid is that the load factor must be high. The load factor we interpret as being 100% when the main carries its full peak quantity throughout the entire day of 24 hours. This desirable state of affairs can only be brought about if there is adequate storage capacity so that the main can deliver throughout the 24 hours at a constant rate, all fluctuations being taken up by the holders. Messrs. Hodkinson and Taylor seem to infer that the load factor can approximate to 100%, but this is surely only true of a load which is almost wholly industrial and non-seasonal. The daily peaks should be smoothed by the storage, but the seasonal peaks cannot be ironed out in this way. There must be considerable periods in each year during which the mains are underloaded, unless the gas is largely sold for industrial purposes. This difficulty, of course, involves higher transmission costs than would be incurred in the perfect system operating with 100% load factor continuously. It is not an insuperable obstacle to the gas grid, however, because the same thing is exactly true of the carbonizing plant at the gas-works. The main may be more favourably situated in this respect than the carbonizing plant, because in supplying a wider area it may well be that the seasonal loads will tend more to equality as one district compensates for another.

THE PROBLEM OF FUTURE COMMITMENTS

A MORE serious difficulty involving costs in distribution is that of the size of the main in the light of future commitments. A gas grid system will last for many years—the Authors suggest "at least 40 years." As they point out, once the mains are laid, the system is inherently inflexible in that additional capacity can only be obtained by increasing the initial pressure—a method that can quickly involve excessive power costs, and so disturb the economics of the scheme. To increase the carrying capacity of the system, therefore, involves either uneconomic power costs for compression or greatly increased capital costs by duplicating the main. The Authors rightly insist that if the considerable outlay involved in a grid system is to be expended wisely, it is necessary to make the best possible forecast of the probable potential loads to be met throughout the life of the main. It is no small task to estimate gas consumption 40 years ahead. The Authors' method did not provoke criticism in the ensuing debate, so presumably it is acceptable to the Industry in general. In itself, however, the necessity for making the main large enough to expand the load carried involves the grid main in excessive capital charges in its early years. Thus, in a typical example given by the Authors the existing consumption in 1944 was 204 million cu.ft. a year, whereas the potential consumption was 773 million cu.ft.; the existing daily consumption was 635,000 cu.ft., and the potential daily consumption was 2,595,000 cu.ft. Thus, the main must be made about four times as large as the economic conditions demand; with consequently increased capital charges. On the other hand, some portion of this increased expenditure will be recovered since the smaller amount of gas transmitted in earlier years requires a lower initial pressure with lower compression costs.

The siting of the carbonizing works demands careful thought. We suspect that whatever has been said about this subject in the past may be disturbed by changed conditions. The first of these new conditions is increased capital costs. The Authors state that the cost of mains to-day shows an increase of 135% over the costs ruling before the war—"a factor which will now render impracticable many schemes of integration which at that time would have been sound economic propositions." Presumably, the cost of building new carbonizing plant will also have considerably increased, and when new plant or new gas mains is the choice, the increased capital cost of the new mains may not be so great a factor. What the Authors probably infer is that the economic value of taking coke oven gas has deteriorated, on account of both increased coal prices and of increased capital charges on the mains.

There is a second important factor—the basis of the commercial discussion. We may visualize discussion between a Gas Industry (possibly nationalized) and the National Coal Board, both being controlled by the Ministry of Fuel and Power. The decision to construct and operate gas grids, whether based on coke oven gas or not, will be taken by a national body (if the Minister's present plans mature) and the strict economic considerations that must prevail in a private or municipal concern may give place in some degree to the desire to bring a gas supply to everyone. What will be the future relationship between gas-works and coke ovens? Is it reasonable to suggest the setting-up of a National Carbonization Board, or a Central Carbonization Board to control the coke ovens and gas undertakings collectively?

The tables given by Messrs. Hodkinson and Taylor indicate a basis for the cost of coke oven gas. They argue that a coke oven unit can compare favourably with other types of gas-producing plant from the point of view of capital cost, labour requirements, and, to some extent, flexibility. They suggest, by giving complete estimated costs, that the total cost of gas purified and metered to the compressors in a particular example is 9.44d. per 1,000 cu.ft. when the ovens are situated at a colliery, and 13.27d. when at a gas-works. This is largely due to the cost of transport of coal to the gas-works. But the Authors credit the two plants with the same value for coke. It would seem more likely that the transport cost of 6s. a ton which will not be needed for the coal must be debited against the coke, since the town will need coke as well as gas. The Authors have laid it down that "the primary factor on which any scheme must be judged is its effect upon the weighted average cost of gas into holder in the area under consideration: only if this cost can be reduced could a scheme be justified." Nevertheless, there are other advantages to be gained by gas grids, some of which are difficult to express in a balance sheet. The problem is one that requires very great care and consideration on a high technical plane.

Diary

Sept. 5.—Industrial Gas Development Committee, Gas Industry House, 2 p.m.
Sept. 9.—Women's Gas Council Executive Committee, Gas Industry House.
Sept. 11.—Domestic Dvelopment Committee, Gas Industry House, 2.30 p.m.
Sept. 10.—B.G.C.: Meeting at Gas Industry House, 2.30 p.m.
Sept. 12.—North British Association of Gas Managers: Annual General Meeting at Rothesay.
Sept. 16.—London and Counties Coke Association: Finance Committee, 11 a.m.; Executive Committee, 11.30 a.m.; Central Committee, 1.30 p.m.; Gas Industry House.

Personal

Mr. JAS. GUYAN, Aberdeen, has been appointed Deputy Gas Engineer to Darwen Corporation.

* * *

Mr. G. BALDWIN, Assistant Distribution Superintendent to the Nelson Gas Department, has been appointed Distribution Superintendent to the Brighouse Gas Department.

* * *

Mr. R. TRAILL, of the Berwick and Tweedmouth Gaslight Company, has been appointed Gas-works Superintendent at Hamilton. He joined the Berwick and Tweedmouth Company two years ago, after serving nine years at Ayr.

* * *

Mr. C. W. HEMINGWAY, who has been for the past four and a half years Deputy Engineer and Manager to the Brighouse Gas Department, has been appointed Joint Assistant Works Manager at the Garston works of the Liverpool Gas Company.

* * *

Mr. W. A. HOWIE, who took over Mr. J. D. C. Woodall's position as Engineer and Manager of the Maidstone Gas Company during the war, is retiring shortly to enable Mr. Woodall, who has recently returned from military service, to resume his position with the Company.

* * *

Mr. F. T. COOPER, of Burnley, has been appointed Showroom Manager and Industrial Salesman to the Motherwell and Wishaw Gas Department, and will commence his duties at the beginning of September. He joined the Burnley Gas Department on leaving school and after five and a half years went to Workington. He has just been demobilised from the R.A.F.

* * *

Captain H. J. KENNARD, R.N., who has been prominent in the management of the Falkirk Iron Company, has now retired from active work but will continue on the Board as Chairman of the Falkirk Iron Company and a Director of Allied Ironfounders, Ltd. At a staff gathering held at Falkirk Capt. Kennard was presented with a portable wireless set subscribed by employees of the Company.

* * *

Mr. G. W. ALLOTT, one of the oldest employees of Newton Chambers & Co., Ltd., has relinquished the duties of General Sales Manager, Ironworks, to become Assistant to the Managing Director (Engineering Sales). The *Thorncliffe News* says: "Mr. Allott is one of the most knowledgeable men in the foundry engineering industry, particularly in the Gas Industry, and his wisdom and experience in that field should be of great service to the Managing Director and to the Company."

* * *

Mr. F. G. MATTHEWS will retire from the position of Engineer and Manager to the Chertsey Gas Consumers' Co., Ltd., at the end of September. Mr. Matthews joined the Chertsey Company in 1913, and since then the annual output of the Company has increased from 40 mill. cu.ft. to 300 mill. cu.ft. Mr. F. SALTER, Local Manager of the Gas Light and Coke Company at Staines, will take over the commercial management of the Company at the beginning of September and will become Manager in succession to Mr. Matthews.

* * *

The end of July marked the close of the long and successful careers of two honoured employees of the Stanton Ironworks Co., Ltd. Mr. E. R. Eaton, Iron Pipe Sales Department, and Mr. J. J. WALLIS Slag Sales Department. Both had been continuously employed at Stanton for 51 years (Mr. Wallis being senior by a few months) and in celebration of the event their colleagues arranged a dinner and presentation in the Club House to which some 40 or more of their most intimate friends were invited. Mr. A. Watson, Assistant Managing Director (Commercial), presided. Mr. F. Scopes, Managing Director, and Mr. P. H. Wilson, O.B.E., Deputy Managing Director, spoke in terms of warm appreciation of such long and loyal service. They were supported by Mr. W. J. C. Cotton, representing the outside staff.

* * *

The Directors of the Gas Light and Coke Company have made the following appointments :—Mr. R. S. JOHNSON, M.A., LL.B., Solicitor, while continuing to hold the appointment of Deputy Secretary. Mr. Johnson joined the Company in 1935 as Assistant Solicitor and was on active service, 1939-45, mostly in the Middle East. He was awarded the M.B.E. last year. Mr. L. H. HARDERN, B.A., Public Relations Officer. Mr. Hardern was Acting Public Relations Officer during the war, and was previously Assistant Sales Manager. Mr. J. A. ROSE, Station Engineer, Southend; previously Deputy Station Engineer, Nine Elms. Mr. L. LACEY, B.Sc., Station Engineer, Harrow (promoted from Engineer-in-Charge). Mr. G. R. ANDERSON, B.Sc., Deputy Station Engineer, Nine Elms. Mr. Anderson was Senior Assistant Engineer, Fulham. Mr. J. S. BARNES, LL.B., Assistant Solicitor (on return from active service). Mr. R. W. CRITTENDEN, Assistant Stores Buyer.

Letter to the Editor

High-Pressure Gasholders

DEAR SIR,—A letter from Mr. Milbourne appeared in your issue of July 17. After refusing to answer the question in my letter published in your July 10 issue, he dilates on the merits of riveting for the construction of high-pressure gasholders, and makes remarks about my "inexperience." In my letter I emphasized the importance of high-pressure holders being *absolutely* tight.

A riveted high-pressure holder, after much caulking of rivets and seams, passed its initial test. Later, under working conditions, serious leaks developed. The holder was eventually made tight by electrically welding rivet heads and seams. Purchasers of riveted high-pressure gasholders would be well advised to insist that leaking rivets on test be removed, and replaced by sound rivets.

Mr. Milbourne should know that electric welding has advanced to such an extent in recent years, that it has replaced expensive hollow forgings for vessels working under a very high pressure, say, 1,000 lb. per sq. in., riveted construction being impracticable. For him to argue that riveted construction is to be preferred to welding on high-pressure gasholders working at only 100 lb. pressure is absurd.

It was suggested at the Institution meeting that it would be desirable to increase the working pressure of high-pressure gasholders to say 250 lb. per sq. in. Electrically welded construction will permit of this.

I am grateful to Mr. Milbourne for drawing my attention to one point which I had overlooked. As the Americans are such enthusiasts on electric welding—they are many years ahead of us—it was only natural that they would take great care when arranging the fleet at Bikini, not to place the welded ship in the path of the blast. Yours truly, For The Oxley Engineering Company, Limited,

H. H. HOLLIS,
Chairman and Managing Director.
Oxley Engineering Co., Ltd.

Clarence Road,
Leeds, 10.
Aug. 2, 1946.

Coal to Fuel Oil Conversion

In a written answer to a Parliamentary Question the Chancellor of the Exchequer has stated that after consultation with the Minister of Fuel and Power he has decided to propose in next year's Finance Bill that the import duty of 1d. per gall. should be removed from heavy fuel oil and gas oil. In the meantime, from Oct. 1 until the date when the import duty is removed, a subsidy of £1 per ton would be paid to consumers in this country of such oils, whether imported or home-produced. The procedure for paying this subsidy and the precise grades of oil to which it will apply would soon be announced.

The Chancellor added that these arrangements would afford an appreciable relief against the higher operating costs of oil-burning plant as compared with coal-burning plant, and he hoped they would result in conversions from coal to oil to the maximum extent possible.

Ministry of Fuel Action

Following the announcement the Ministry of Fuel and Power states that steps are being taken to encourage conversion of plant temporarily from coal burning to oil fuel burning where it is clear that this may be done with advantage to relieve the present and prospective pressure on coal supplies.

Every assistance will be given to industrialists desiring to make the change and arrangements have been made for ordering in bulk the necessary equipment and oil-burning appliances so that the change, where applicable, may be made as speedily as possible.

Regional Officers of the Ministry of Fuel and Power are now consulting industrial undertakings where plant conditions are suitable for conversions to oil from the point of view of helping the coal position as much as possible next winter. In making this review of possible conversions, special attention has been paid to continuous process industries.

Included in the review are those cases where conversions could be carried out quickly and, in addition, cases where new plant and equipment would be required but where conversion would nevertheless be desirable in order to help the difficult coal position. Discussions are taking place with the gas and electricity industries and the railway companies.

Direct applications from consumers for conversion to oil firing are being authorized though, with a few exceptions, the quantity of oil involved in each case is relatively small. The Ministry is now prepared to authorize the use of oil in stand-by plants provided heavy oil is used and the plants are brought into continuous use; it is not practical, owing to distribution difficulties, for oil to be supplied to these plants for intermittent use.

The Minister of Supply (Mr. John Wilmot) will perform the opening ceremony on September 12 of a new gas appliance factory on the Team Valley Estate, Gateshead, for De La Rue Gas Development, Ltd.

The Gas Industry in Holland: 1939-1945*

By P. HIJDELAAR

Secretary, Netherlands Gas Association

THE Gas Industry in the Netherlands met with great difficulties during the war, not only in obtaining coal, but also from many hinderances in obtaining materials required for enlargement and maintenance of various kinds. These difficulties were attended, as will appear below, by an ever-increasing demand for gas consequent upon shortage of other fuels.

Immediately after the outbreak of war in September, 1939, the Government Coal Office was formed to arrange the distribution of coal. On Jan. 1, 1940, stocks at gas-works were still very satisfactory, and amounted to a reserve sufficient for nearly four months. When, in May, 1940, Holland became involved in the war, it was dependent upon its own production which, in the course of time, had to be made up by imports from Germany. On the other hand, in 1940 an increased export of coal to Germany was desired.

From Dec. 14, 1940, Decree No. 1, concerning gas and electricity, came into force, and the gas ration during 1941 for all gas consumers was fixed, for a two months' period (meters were read every two months) at 100% of the consumption in the corresponding period of 1940; and each consumer was allowed 2,120 cu.ft. as a minimum for domestic purposes.

The coal position having become worse and worse led to the fact that, from July 1, 1941, the percentage of 100 had to be reduced to 75, with the exception of some groups of vital works and some undertakings which were charged with the execution of German orders, by reason of which they were privileged by the "Rüstungsinspektion Niederlande." In spite of this rationing, total gas consumption in Holland increased gradually. The most important cause was shortage of fuel oil, of which the consumption in the Netherlands for cooking and lighting amounted respectively to 210,000 tons and 30,000 tons in normal years. This liquid fuel (kerosene) had to be replaced by gas, so that the number of gas consumers increased considerably.

Gas for Motor Cars

There was also an increase in the consumption of gas for industry, and a gradual development of the use of gas as motive power for motor cars consequent upon lack of petrol. The last-mentioned consumption increased to 1,588 mill. cu.ft. a year during the war. In spite of all measures of economy, annual gas production showed a considerable increase, as will be seen from the following table of gas production from all gas-works (including the supply from blast-furnaces and from the State Mines giving a direct supply to industry):—

Year	Gas Production (mill. cu.ft.)
1938	23,400
1939	24,500
1940	26,400
1941	29,600
1942	33,400
1943	33,000
1944	27,900
1945	11,800

The rationing was maintained until August, 1944, when the German authorities decided to reduce the percentage of gas for domestic purposes from 75 to 65% of the consumption in 1940, while all over the country gasless hours had to be introduced, gas being supplied only during the hours 7 a.m. to 8 a.m.; 11 a.m. to 1 p.m.; and 3 p.m. to 7 p.m.

After Allied troops marched into the provinces of Limburg and Noord-Brabant, in September, 1944, the coal supply, especially in territory occupied by the Germans, continued to deteriorate. Imports from Limburg or Belgium could not be relied upon; while only a very small quantity came from Germany, which the German Authorities, when they withdrew to the Dutch-German frontier, directed principally to a number of gas-works and electricity concerns in the northern and eastern parts of the country. So Holland was thrown exclusively upon its own resources, and very soon the supply of gas and electricity in the territory occupied by the Germans came to a standstill. Gas production at most of the gas-works was suspended in October, 1944.

In the southern part of the country, as far as the works had not been damaged, the gas supply could be continued, based upon 50% of the consumption of 1942. In this way gas could be supplied for domestic purposes during 2½ hr. per day. It was not until a long time after the liberation of the western, eastern and northern parts of the country, that the gas supply could be resumed, with the assistance of coal produced in the country and imported from England, America and Germany; so that gas-works in these parts of the country only came into operation in August, 1945. This is shown clearly in the low annual production figure for 1945 given above.

Coal Shortage

Gas supply continues to meet with great difficulties owing to shortage of coal. Inland production and imports from America and Germany together are not yet able to provide a quantity of coal sufficient to supply the normal demand for gas. The present ration of gas is much too small: for domestic consumption it is 1,410 cu.ft. per two months for a family of three persons with an additional 212 cu. ft. for each member of the family in excess of three. Industry is rationed at about 70%.

During the war gas-works, and in particular gasholders, were damaged considerably, primarily through air attacks and other acts of war. Out of about 200 gas-works, 48 had one or more of their gasholders damaged. With few exceptions, this damage has now for the greater part been repaired. The distribution systems of 30 gas-works were seriously damaged; but damage to buildings and apparatus occurred only to a small extent.

The gas-works at Arnhem was considerably damaged by acts of war; similarly the works at Nijmegen and Tiel, and some others in the southern part were badly hit. With few exceptions, they have all been repaired, so that it has been possible to resume the supply of gas.

In general, gas-works are now in a bad condition. Maintenance has been impossible during the war years because of lack of materials and at most works retort installations particularly are in such bad repair that they must be renewed and enlarged to meet the increase in gas consumption expected to follow upon the end of rationing. Repairs are very difficult, particularly because of shortage of the necessary refractory materials. The only makers of refractory material are unable to meet the demand, whilst it is very difficult to obtain material from abroad.

It is to be expected that, in the near future, there will be some difficulty in providing unlimited supplies for gas consumers. Gas is supplied in Holland, with the exception of the State Mines in Limburg and the blast-furnaces in Imuiden, by 155 gas-works, of which 133 are municipally owned and 22 are privately owned. One hundred of the larger of these gas-works, in 1943, were responsible for 96½% of total gas production; the remaining 55 works consequently accounted for only 3½%. As will appear from these figures, gas production in Holland is spread over too great a number of small gas-works. Centralization of gas supply has become such an urgent need that the Government has set up a Commission to prepare a scheme. Particular consideration will be given to the question of how far the coke oven installations of the Limburg mines could take over gas supply, while later it is to be expected that production will be concentrated in larger works.

* From "The Gas Industry Overseas, 1939-45." Communication No. 299 of the Institution of Gas Engineers.

Examinations in Salesmanship

The Incorporated Sales Managers' Association announces that the next examination in salesmanship will be held in London and various provincial centres on Oct. 26. Normally the examinations are held annually in March, but this year there is an additional examination, which, however, will not be accepted as exemption from "The Principles and Practice of Salesmanship" in Part 2 of the I.S.M.A. Final Examination.

No evidence of general education is required from candidates, but the Paper will include the composition of at least one sales letter, which must afford evidence of ability to write good English. The syllabus covers (1) Function, scope, and development of personal selling; (2) Psychological aids to salesmanship; (3) Fundamentals of salesmanship; (4) Technique of salesmanship; (5) Various selling methods; and (6) Salesmanship as the creation and conservation of goodwill.

Entry forms are available from the offices of the Association, 23, Bedford Square, London, W.C.1, and must be completed and returned with the entrance fee of 10s. 6d. on or before Sept. 30.

Blackburn Gas Committee proposes to spend £21,000 on additional 24 in. and 18 in. mains and a new 24 in. governor at the Greenbank works to improve supplies to the moorland township of Mellor and to reinforce the pressure in other districts and for industrial purposes.

Copies of the British Standard Specification B.S.1322: 1946 Synthetic Resin (Aminoplastic) Moulding Materials and Mouldings, may be obtained on application to the Secretary, the Institution of Gas Engineers, 1, Grosvenor Place, London, S.W.1, price 2s. net, post free.

Development of a Gas Grid*

By W. HODKINSON
General Manager, United Kingdom Gas Corporation, Ltd,
and
H. B. TAYLOR
General Manager, West Riding Group of Gas Companies

FOR some considerable time it has been realized within the Industry that in certain areas co-ordination of gas manufacture, and inter-linkage of gas supply would prove advantageous, and in fact such co-ordination has been taking place, examples having been presented and discussed before the Institution of Gas Engineers in past years.

During the war the Industry spent considerable time and effort in examining plans for the post-war period, and generally the conclusions were in favour of the formation of centralized manufacturing units, with area distribution by means of gas grid systems, in certain regions which offer scope for such development.

The Authors have been fortunate in assisting in the development of the West Yorkshire Gas Distribution Company from its inception, and in investigations into the economics of bulk gas manufacture and supply in the four areas in which United Kingdom Gas Corporation, Ltd., has interests. In this Paper, which is based upon the experience so gained, they have attempted to draw attention to some of the factors which influence the development of a gas grid, and, in using as their example the possible further extension of the present West Yorkshire grid, they have repeated in large measure the proposals drafted by Col. W. M. Carr, O.B.E., T.D., Managing Director, United Kingdom Gas Corporation, Ltd., for incorporation in the original Bill of the West Yorkshire Gas Distribution Company.

No detailed description of the construction of the grid, nor of its operation, is included, as this is covered by an earlier Paper†, which also gives constructional costs.

It may be of interest to compare the transmission costs given here with those for a similar scheme covering South Wales.‡ To adjust the latter for the increased capital costs obtaining to-day, interest and sinking fund charges should be increased by 15%.

We believe that this and the earlier Papers demonstrate that in certain areas a case can be stated for the detailed investigation of the economics of area gas supply. Unfortunately, following upon six years of war restrictions, with few exceptions, the carbonizing plant in gas undertakings throughout the country is in urgent need of reconstruction, and in many cases immediate extensions are required to meet the demands of new housing and industry. The time is thus rapidly passing when such area schemes can be initiated, as the possible economics of centralized production and grid transmission are not sufficient to justify the writing-off of capital recently spent on the reconstruction and extension of reasonably efficient manufacturing plant.

West Yorkshire Gas Distribution Company

This Company was planned and developed by Col. W. M. Carr, Managing Director of United Kingdom Gas Corporation, Ltd., of which undertaking it is a subsidiary. It is the first Statutory Distribution Company to be incorporated as such, deriving its powers from the West Yorkshire Gas Distribution Act, 1938.

Three points of importance may be noted in this Act:—

(1) The principal object is the co-ordination of gas supplied.
(2) Gas may be bought from both coke ovens and gas-works.
(3) Gas may only be sold to other gas undertakings.

The scheme is therefore a true bulk distribution system, planned for the sole means of effecting co-ordination of manufacture and supply over a wide area. In this respect it is entirely different from other schemes in this country and on the Continent, which were primarily designed for the collection of crude coke oven gas.

The Company's mains system, as at present developed, amounts to 78.6 miles, while a further 55 miles of main, operated by consumer undertakings, are fed with high-pressure gas from the grid, the whole supplying an industrial and rural area of 450 sq. miles. The density of the system, *i.e.*, the average length of main between each station, is at present 4.15 miles, 19 stations being supplied from four coke oven plants. The mains are from 4 in. to 18 in. bore, and are generally of spun iron with mechanical joints, exceptions being some 5 miles of 8 in. mains and all overground " special crossings " where steel main has been used. The system was tested with air at 60 lb. per sq. in. pressure, and is designed for working pressures of 35 to 40 lb. per sq. in., compressing stations, using electrically, steam, or gas engine driven compressors, being under the control of the supplying undertaking. Only purified gas, maintained to a rigid specification standard to all sources of supply, is transmitted, this attaining the desired standardization of calorific value and specification over a wide area.

* From Communication No. 298 of the Institution of Gas Engineers.
† " Gas Distribution." Coke Oven Managers' Association, Sheffield. April 29, 1942.
‡ " Area Gas Supply." The Wales and Monmouthshire Association of Gas Engineers and Managers, Cardiff. Sept. 28, 1944.

Due to war-time restrictions, construction of a new central production station at Tingley is only now becoming possible, and in consequence gas is having to be made at the present time at six of the stations connected to the grid, each of which is receiving only partial supplies of coke oven gas. As soon as the new works, which will have a capacity of 16 mill. cu.ft. per day, is completed, manufacture at these stations will be discontinued.

Development of the Company's grid to meet the requirements of the undertakings at present controlled by United Kingdom Gas Corporation, Ltd., is projected. As planned, the system will then comprise 147.1 miles of mains supplying gas from five coke oven plants and one large new gas-works to 27 holder stations, and covering an area of 670 sq. miles. The density of the system would then be 5.45 miles per station.

Table 1 shows the expansion in gas sales from 1938 to 1944 of each of the 12 stations originally connected to the grid in 1939. It is encouraging to record that this considerable expansion, amounting to an increase of 119% in eight years, has not been retarded by the transition from war to peace production, and, as explained below, we are planning for a further average increase of 93% over 1944 loads. In passing we would suggest that our experience leads us to doubt the soundness of the Heyworth Committee's conclusion that the Industry " in 10 years' time will have increased its sales to at least 20% above the level of to-day."

TABLE 1.—*Expansion of Gas Sales of* 12 *Stations Originally Connected to the Grid in* 1939

Company	1938 (Thous. cu.ft.)	1940 (Thous. cu.ft.)	1942 (Thous. cu.ft.)	1944 (Thous. cu.ft.)	Percentage Increase, 1944 over 1938
Castleford	211,504	239,527	373,236	458,042	117
Featherstone	42,724	43,095	55,346	68,215	58
Garforth	14,630	17,674	21,038	25,859	78
Kippax	15,707	14,043	15,841	20,419	30
Knittingley	33,072	48,999	128,604	176,702	436
Morley*	142,000	155,680	241,621	263,179	85
Normanton	57,429	46,227	53,185	72,361	26
Pudsey	187,372	228,833	362,871	343,450	84
Rothwell	70,605	127,398	231,928	254,072	258
South Milford	6,664	8,450	20,463	30,366	355
Total	781,707	929,926	1,504,133	1,712,665	119

* NOTE.—Morley Corporation Gas Undertaking acquired April 1, 1940, and amalgamated with the East Ardsley and the Drighlington Gas Companies into the Morley Gas Company. For comparison purposes the amalgamation has been assumed as from January 1, 1938.

This expansion is by no means entirely due to the grid, except that it was made possible by the availability of adequate supplies of gas. Some undertakings, notably Castleford and Rothwell, have been purchasing coke oven gas for upwards of 20 years, but, thanks to a progressive sales policy, particularly as applied to industrial gas, the sales of these two undertakings have increased in the above period by 117% and 258% respectively.

Points Affecting the Design of Gas Grids

The load factor of a gas distribution system may be expressed:—

$$\frac{100 \times \text{(potential gas transmitted per day in cu.ft.)}}{24 \times \text{(peak rate of flow in cu.ft. per hr.)}}$$

The load factor of a normal distribution system designed to meet 100% expansion in demand would approximate to:—

	%
Initial loads	12½ to 16½
Potential loads	25 to 33
Average loads	19 to 25

The load factor of a grid system, also designed to meet 100% expansion in demand, can be made to approximate to:—

	%
Initial loads	50
Potential loads	100
Average loads	75

The importance of securing a high load factor in the case of a gas grid can be illustrated by considering a section of such a grid and costing out the mains, using a final load factor of 33% and, alternatively, 100%. Such a section comprising 26.8 miles of main supplying seven stations would cost £346,000 if designed for a potential load factor of 33%, but only £202,000 if this be increased to 100%. Thus, the lower load factor would entail an extra cost of £144,000, or approximately 70%.

The improved load factor can be obtained in the case of grid mains by the use of storage capacity at all major receiving stations, and it is of first importance that existing storage be maintained and developed as expansion takes place. In this way gas is taken steadily from the grid over the 24 hr. of each day, the gasholders meeting the fluctuating demand of the local system exactly as when gas was being manufactured at the local station.

The method of controlling a grid to bring about this high load factor was described in detail in 1940. In essence, each source of supply compressing gas into the grid, and each station taking gas from the grid, does so at a steady, predetermined rate. Thus the total quantity of gas per hr. taken from the grid equals the total quantity put into the grid, these conditions being held throughout the 24 hr. of each day. Any desired variation from the predetermined rates, either of take or input, must be notified to the control office, where arrangements are at once made for compensating variations. The control is thus essentially one of rates of flow, the pressure obtaining in any part of the grid being entirely secondary.

Development of New Appliances

This fundamental difference from an ordinary system entailed the development of new control appliances in place of the normal outlet pressure regulation of compressors and district governors. The apparatus evolved was described in detail in 1940, but the principle, which involves the maintenance of a predetermined rate of flow by ensuring a constant pressure difference across an orifice plate, can be applied equally to control compressors or governors.

It has been suggested that the grid mains, which generally pass right through an undertaking's area, be used for reinforcing deficient district pressures in the outlying portions of that area. While there are no technical difficulties, such tappings would destroy the high load factor of the grid and would cut across the method of control, in that the rate of take by such district governors would be dependent only upon the demand of the area concerned.

Most undertakings are now in the position where their existing distribution systems are loaded to capacity, if, indeed, they are not already overloaded, and are faced with extensive main-laying necessary to provide for the anticipated increase in demand. Generally, such new trunk mains will comprise feeder systems working at intermediate pressures. A modified form of volumetric governor can be used to accept gas from the grid at a constant predetermined rate, passing it forward at intermediate pressures into the local undertaking's feeder system, any gas surplus to the requirements of the feeder system being relieved into holders. Should the demand of that system exceed the steady rate of input from the grid, the latter is augmented by gas compressed from stock. In this way, the grid's requirements as to constant rate of take are met and the local undertaking's compression costs are minimized.

A case is under consideration at the present time which illustrates the lengths to which we go to maintain the high grid load factor. Considerable development is taking place in part of an undertaking's area remote from its holders, but in an area traversed by the grid main. To maintain the constant rate of take from the grid either a local high-pressure feeder main can be laid from the holder station to the developing area, a main which will in large part run parallel to the grid main, or another holder station can be built in the outlying district. The station can use either water-sealed holders, when it must have a resident attendant, or high-pressure storage remotely controlled from the parent station. In either case the input to the station would be taken at a steady rate. The selection of the most economical alternative is straightforward.

Variable Loads

Variable loads must occasionally be taken directly from the grid as when the mains traverse rural areas otherwise remote from gas supplies, many villages can be given a service in every way equal to that obtaining in the towns. In such cases, where the number of consumers involved is small, it is clearly uneconomical to install a holder station, and the total variation in these rural demands can have no noticeable effect on the general load factor of the grid. For village supplies, therefore, a Reynolds district governor and B.M. meter are installed in a suitable small building.

Arrangements have been made with the housing authorities responsible for the post-war building in villages having projected district governor stations, for all their new houses to be completely fitted with gas installation pipes during erection, the undertaking bearing the cost of such installation until gas supplies are brought to the village, when the housing authority will reimburse the undertaking with £7 5s. per house. This is a variation of the general proposals for the gas installation of new houses in force throughout the undertakings controlled by United Kingdom Gas Corporation, Ltd.

Where rural areas are supplied direct from grid mains as, for example, from the projected main between Knottingley and Rawcliffe, it is very necessary that the section of the grid involved be designed for the lower load factor, and provision must be made for the maintenance of supply at times when the grid may be cut for maintenance purposes. The normal practice is to provide a small compressor at the most remote holder station, this to compress gas back from stock into the grid on such occasions.

A grid system will have a life of at least 40 years. Once the mains are laid, the system is inherently inflexible in that additional capacity can only be obtained by increasing the initial pressure—a method which can quickly involve excessive power costs. For geographical reasons it is frequently impossible to augment the carrying capacity of the system by laying additional mains, short of duplicating a complete section. Very considerable capital outlay is involved in an extensive grid system, and if the money is to be wisely spent it is clearly necessary to make the best possible forecast of the potential loads to be met many years hence. Obviously these can only be approximately determined, but there is every difference between a reasoned estimate and a guess.

Survey of Potential Loads

The method used may be of interest. Firstly, the present domestic demand is analyzed and a target is set for the long-term consumption per existing domestic consumer, which in industrial areas is generally 120 to 175 therms per ordinary consumer, and 100 to 120 therms per prepayment consumer. In residential areas the target is increased to 200 to 250 therms per ordinary consumer. Consideration is given to the number of connectible households not at present consumers, and, if this is abnormal, a proportion is included at the foregoing consumptions. A survey is then made of the new property which may be built within the area, full use being made of the housing authority's knowledge of potential municipal building development and of the surveyor's or planning officer's knowledge of additional land scheduled for private development, using an appropriate figure for the number of houses per acre. Consideration is given to outlying areas not at present supplied with gas, but which are likely to be given a supply over the period in question. The additional consumption by these potential domestic consumers is then estimated, allowing 200 therms for both prepayment and ordinary consumers in the case of new houses, and an appropriate figure, generally 100 therms, for existing houses now without a supply. In this way a reasoned estimate of the potential domestic demand many years hence is obtained.

An explanation may be given of the apparently high figure of 200 therms for all new houses, whether these are to have prepayment or ordinary consumers. All new houses in this area are having a minimum of seven points installed during erection, and most are having several gas appliances included by the housing authority. With these facilities, with the demand for a higher standard of living, and with the increased purchasing power of the tenants, we believe that this average consumption can be attained.

A survey of all potential industrial and commercial loads in each district is made by experienced engineers, capable of assessing the total heat requirements of the various industries which can be met economically with gas at prices likely to be made available by means of the grid. So far as existing industries are concerned reasonably accurate forecasts can be made. It is, however, necessary to make assumptions in the case of areas scheduled for industrial development, but where at present no information can be obtained as to the type of industry which may be established.

The Authors believe that the method described above does provide a reasonably accurate estimate of the potential loads, to meet which any grid system must be designed. Identical methods are used by them in the design of local feeder systems, excepting that in such cases the area of the undertaking under consideration is subdivided into many small districts, the demand from which provides point loads for the design of the feeder system.

The potential loads for the 27 stations at present controlled by United Kingdom Gas Corporation, Ltd., are based upon reasoned estimates as described above. It will be seen that the percentage increase over 1944 loads various from 70% to 290%, and averages 93%. A single load of 2,000 mill. cu.ft. per annum has been excluded, in that it would have tended to mask the comparative figures which we give.

It is interesting to compare the present estimate of potential load with that prepared in 1938, when the original grid was designed. At that time 12 stations were making a total of 850 mill. cu.ft. per annum, and the Authors provided for a potential demand by them of 5,350 mill. cu.ft. per annum, an increase of more than 500%. By 1944 the demand of these 12 stations had reached 1,909 mill. cu.ft. per annum, an increase of 125%. The present estimate of potential load by these 12 stations, including the special load mentioned above, amounts to 5,619 mill. cu.ft. per annum—a very close check upon the original survey.

Planning to Finality

The Authors have, of course, been unable to make a detailed survey of those of the 71 stations proposed to be connected to the grid, which are not constituent companies of United Kingdom Gas Corporation, Ltd., but they have assumed the conservative increase of approximately 80% on each undertaking's 1944 loads, making an average increase for the area of 87%. While these figures are sufficiently accurate for the purpose of this Paper, it will be apparent that much work will be necessary before potential loads acceptable for the final design of a grid can be obtained.

The present West Yorkshire grid has been designed to meet the restrictions imposed by the West Yorkshire Gas Distribution Act, 1938, when Parliament thought fit (no doubt due to the opposition of other undertakings in the area) to reject the area proposed in the

original Bill, and to restrict the Company to the existing limits of undertakings controlled at that time by United Kingdom Gas Corporation, Ltd. In spite of the opposition, it was realized when the original sections of the grid were being planned that ultimately they would have to fit in to some larger whole, and the resulting grid is, therefore, something of a compromise. While it admirably meets the requirements of the constituent Companies of United Kingdom Gas Corporation, Ltd., it can also serve as the nucleus of a regional grid. The Authors would stress the major importance of planning any regional grid scheme for finality. Before any pipe is laid, the area to be ultimately developed should be determined, with all that this entails in assessing the potential loads to be provided for, the possible sources of coke oven gas, the best and most economical sites for major manufacturing stations, and the economics of bulk distribution. Once these points have been settled (and the Industry, if it applied itself to the problem, could settle them within a reasonable time), all main-laying and plant reconstruction could be carried out to a rational plan, each piece fitting together as in a jig-saw puzzle until ultimately, perhaps 15 years hence, the last pipe is laid and the last works is shut down.

While the possible further development has been extended to include a number of remote rural gas undertakings (these considered independently being entirely uneconomic, but adding little burden to the average transmission costs of the area as a whole), there remain many further undertakings too remote for bulk supply, and which must continue to manufacture. The limits to which a grid can be extended depends entirely upon the extent to which the more fortunately placed undertakings can subsidize the rural undertakings in the averaging of transmission costs. In the West Riding there is a dense mass of urban development to balance these rural extensions, but the fact that in this case they may be considered economic should not lead to hasty conclusions. Each area must be considered in detail on its own merits, as the Authors have found from experience that such consideration brings to light very remarkable differences in the average cost of transmission in areas thought at first to be not dissimilar.

The Authors believe that this point requires the greatest emphasis. In their experience there is no easy way to determine the economic limits of a grid system, the only proper course being to develop each scheme in detail, with consequent expenditure of time and labour, which will be apparent from this Paper. They feel quite sure that the magnitude of the task to be faced, if a proper investigation, covering all relevant parts of the country, is to be undertaken into the potential benefits of bulk supplies (and their very definite limitations) is not appreciated in any quarter. Merely drawing lines upon a map can only lead to disaster.

Legislation Affecting Gas Grids

With the development of grid mains, giving bulk supplies of gas to undertakings and not serving the normal consumers direct, the desirability of laying mains away from the highway became apparent. Advantages of cross-country mains include:

(1) Lengths may be shortened, with consequent smaller diameter pipes and/or lower initial pressures.
(2) Disturbance of highways and of the general public is avoided.
(3) Congestion of services in highways is minimized.
(4) Speed of main-laying is increased and labour is saved by the extended use of mechanized equipment.
(5) Expensive reinstatement is avoided.

In the construction of the West Yorkshire Gas Distribution Company's system some 30% of the mains have been laid across country. So far 132 wayleave agreements have been entered into.

The Company has no statutory powers in respect of wayleaves, and in some cases the refusal of one landowner to negotiate has led to the most economical route for a main having to be abandoned, even though all other wayleaves in respect of this route have been negotiated. Thus work cannot be commenced until all wayleaves are completed. In the case of sections covering mains which had to be laid at short notice, the proportion laid under wayleave is much below that in the other sections where more time was available for negotiation. It is suggested that, if bulk supply of gas is to be facilitated, the supply undertakings should possess some such powers as are now enjoyed by electricity undertakings for the compulsory acquisition of wayleave facilities, subject to suitable safeguards to the public.

Rating

Under the terms of present legislation the formation of a separate distribution undertaking for the purpose of co-ordination of gas supply throughout an area entails assessment for rates upon the earning capacity of the undertaking. A gas supply undertaking contracting to take bulk supplies of gas from a distribution undertaking is in no way relieved of liability to rates on its own trading position, and therefore, to a certain degree, the ultimate consumer of gas is called upon to bear the cost of additional rating.

The incidence of the additional cost upon the consumer is difficult to assess in terms of money; it may, in fact, be quite small, but we consider that there is a case for the examination of rating principle as affecting distribution undertakings, as under present legislation the ultimate consumer may be called upon to bear more rates than would be the case if, instead of taking a bulk supply from the distribution undertaking, the gas supply undertaking reconstructed its own works.

The design, construction and subsequent operation of a planned grid system covering a number of production and supply points, as distinct from a small inter-linkage system, calls for specialized technique in that such a system, in effect, operates to co-ordinate production and bulk supply throughout its area, the grid assuming responsibility for balancing supply against demand. Thus, a central control is inevitable, and the Authors are therefore of the opinion that such grid systems must have a separate statutory entity distinct from individual supply undertakings.

(To be continued.)

Damages for Broken Mains

A test case regarding damage to gas mains by mining subsidence, heard by Mr. Justice Evershed in the Chancery Division, has been decided in favour of Newcastle-under-Lyme Corporation. The Judge, in a reserved judgment, found that the damage was caused by subsidence due to mining operations by Wolstanton, Ltd., and he awarded £4,500 agreed damages to the Corporation.

His Lordship found that the damage resulted from the general effect of mining subsidence, and said plaintiffs had not proved to his satisfaction that the damage was due to unreasonable and improper working of the defendant's mines.

The outcome of the case has been regarded as of great importance, inasmuch as it concerns all local authorities in mining areas.

Defendants denied liability.

The case related to damage done from 1936 to 1943, when the Railway and Canal Commission gave the owner of the minerals the right to let down the surface, subject to the payment of proper compensation to persons whose buildings were injured.

The Corporation claimed that the repairing and replacing of damaged mains and the loss of gas had cost them a large sum of money.

The hearing of witnesses and counsel's speeches occupied 11 days.

His Lordship, giving judment, said that no trouble arose until the year 1934, but from that year until the issue of the writ damage was admittedly done to the gas pipes as a result of the movement of the surface land attributable to the defendants.

His Lordship referred to a decision of the House of Lords to the effect that mineral owners could not let down the surface without payment of compensation for damage which ensued, and said the defendant company had obtained from the Railway and Canal Commission orders empowering them to work the minerals, subject to the payment of compensation. The claim of the Corporation was confined to the six years prior to 1942, and the damage alleged amounted to £8,419, made up as follows:—Cost of repairing broken gas mains £812, cost of replacing pipes £5,659, and loss of gas £1,938.

The plaintiffs had satisfied him that, substantially, the whole claim represented damage caused as a direct result of the defendants' mining operations, and no serious attempt was made to attribute the damage to frost or any other cause. The Corporation had proved a loss quantified at £8,410.

Dealing with the question whether the Corporation had any right of law against the defendant company, he held that their interest, as undertakers, must be that of licensees without any right or title to the land itself.

The Corporation could not say there was vested in them any right of support as such, or that they were the inheritors of such rights of support; but did it follow that they could not sue for damage suffered by any unlawful interference with the surface land ? In his judgment, the answer was " No."

The cause of action was from the unlawful interference with the natural right of support for the surface land and the damage suffered was the direct result of the defendants' interference with that natural right of support for the surface land. He was not satisfied that plaintiffs had proved that the damage was due to unreasonable and improper working of the defendant's mines.

As to the suggestion that the damage was caused by the simultaneous working of two seams, he said that if two seams were worked simultaneously the total amount of subsidence would not be substantially different from that which would be caused if the two seams were worked at different times. He was satisfied that the defendants did not embark on simultaneous working lightly, or without proper consideration of the risks involved, and such working ought not to be condemned as being unreasonable or improper. He was not satisfied that the Corporation had proved that any of the damage suffered could be attributable to simultaneous working, as distinct from the general effect of the subsidence caused by mining operations.

The Corporation were entitled to the relief claimed, and to an enquiry as to damages, or, if the parties wished him to assess them he would do so to the best of his ability.

Mr. Wilfrid Hunt (for the Corporation) said he understood that the damages had been agreed.

Mr. Justice Evershed: At what sum ?

Mr. Andrew Clark, K.C. (for the defendants) said he was instructed that the damages had been agreed at the sum of £4,500.

Mr. Justice Evershed accordingly gave judgment for the plaintiff, Corporation for £4,500.

High-Pressure Gasholders*

By G. M. GILL,
M.Inst.C.E., M.I.Mech.E.

(Continued from p. 241)

CONTINUING the discussion Mr. **C. M. D. Belton** (Shrewsbury) said: An electrically driven vertical reciprocating compressor was decided upon, and housed in a building designed to accommodate a duplicate set and the necessary auxiliary equipment. No. 1 compressor is by Bryan Donkin, capable of dealing with 4,000 cu.ft. per hour a 60 lb. per sq. in. pressure, driven by an electric motor of 12½ brake horse power. Four storage tanks 30 ft. long by 8 ft. in diameter were originally connected to this compressor, giving a total storage capacity of 24,000 cu.ft. During the war an Emergency Military Hospital was built not far away from the station and with other increased demands, it was soon found necessary to install a second compressor of double the capacity. Four further storage vessels 9 ft. diameter by 35 ft. long were also required, but only two were allowed by the Ministry in 1943; the remaining two are being installed this year, thus increasing the storage capacity to 81,000 cu.ft. A second and larger compressor was installed capable of dealing with 8,000 cu.ft. per hr. at 80 lb. per sq. in. pressure. The second compressor is also by Bryan Donkin and is driven by a 30 brake horse power motor.

The specifications provide for an input of 4,000 cu.ft. and 8,000 cu.ft. per hour against 60 and 80 lb. pressure per sq. in. but should the compressor start when the tanks are empty, the demand would be considerably more than this, and to provide against over pulling a Bryan Donkin volumetric governor is fixed on the inlet supply, and in the case of the large plant is adjusted so that no more than 8,000 cu.ft. per hr. is taken. Corresponding adjustment is also made in the case of the small plant when it is brought into use.

The high-pressure outlet governor is of the Reynolds type, but with the valves falling to seat, so that there is no risk of undue pressure being put on the district. The auxiliary system consists of a high-pressure governor, two low-pressure governors, one being clock-controlled for an increase in pressure on Sundays, and there is also a magnetic valve in the circuit which is controlled from each panel, so that should the compressor be started when gas is passing out, the Reynolds governor is put out of action.

Normally the plant is entirely automatic, but complete hand switching arrangements are provided for putting either No. 1 or No. 2 plant into action. There are two auxiliary systems common to each main control panel:

(1) (*a*) Maximum and minimum pressure control (*b*) Time control. At present we are running between 60 and 75 lb. per sq. in. and the time for running is between about 11 p.m. and 5 a.m.

(2) An electrical relay is provided with each plant, and three protective devices, fitted with mercury switches, are wired in parallel to provide for the following:—(*a*) Overheating of water circulation; (*b*) non-delivery of oil to bearings of compressor; (*c*) very low inlet gas pressure (the minimum is now set at 25 tenths).

If any of these occurrences take place, the compressor is immediately stopped, and must be reset by hand. A number of small cylindrical storage vessels are preferred to the larger type for three reasons: (1) They are unobtrusive in residential surroundings; (2) maintenance and insurance inspection is facilitated; (3) transport and erection is not so difficult.

The storage vessels are cylindrical shells fabricated of four circular belts of $\frac{7}{16}$ in. thick boiler plates with end plates $\frac{3}{16}$ in. thick, both dished outwards, the longitudinal seams being double riveted lap-joints and the circumferential seams single riveted lap-joints. The working pressure is 80 lb. per sq. in., but the vessels were tested hydraulically to 160 lb. per sq. in.

Some difficulty occurred with insurance as the Company originally stated that they required frequent internal examination. This request was obviously due to lack of appreciation of the actual conditions and eventually it was agreed that an internal inspection of one of each group every year would suffice. One source of trouble was the safety-valve on the storage vessels, and from tests on spring and weight loaded safety-valves it was found that when the pressure reached to within 5 lb. of the set pressure the valve would commence to ease off the seat, and thus allow serious wastage of gas. Also once the valve had started to blow it would take a pressure drop of about 7 lb. before the valve finally closed. A special type of safety-valve was therefore designed with a balanced diaphragm controlled by a small pilot valve and this has proved satisfactory, the range of operation being reduced to 2 lb.

The total capital cost of the land, building, compressors and receivers amounts to £6,596. The power used works out at 2.9 units per 1,000 cu.ft. compressed. There have been, of course, minor "teething troubles," but the experience gained has been invaluable.

A municipal post-war housing scheme is now developing on the fringe of the town necessitating further storage and again no difficulty is being met with in securing a site for high-pressure storage.

* Communication No. 296 to the Institution of Gas Engineers.

England's Oldest High-Pressure Holder

Mr. J. **McNair** (Skipton):—I have been asked to contribute to this discussion because Skipton possesses the oldest high-pressure holder in this country, and experience goes to show that Mr. Gill's claim for the high-pressure holder is justified. This holder continues to give excellent service and the maintenance costs are still within the figure quoted in the Paper. The holder is situated over a mile from the works and this is a special advantage in that we are free from the trouble and expense of steaming in winter. Another point is that the pressure gauge at the works end of the main provides a convenient and reliable means of estimating the gas stock at any time. From enquiries I have received from time to time, I should say that there is a tendency in the first instance to over-estimate the proportion of gas which will have to be compressed and also to lose sight of the fact that there is always a basic reserve of gas which is seldom touched. In Skipton we have a total holder capacity of 600,000 cu.ft., equal to a maximum day's demand, and of that, 250,000 cu.ft. is stored under most economically high-pressure conditions. The maximum use made of the high-pressure gas is about 100,000 cu.ft. per week at the change of the season. At other times, however, as long a period as two months passes without the holder having to be brought into use at all. I may say that any doubt I might have harboured regarding the high-pressure holder in the first place, were dispelled after a few weeks' experience, and I am sure that the high-pressure holder in the future will offer the best solution to many storage problems.

Peak Load Difficulties

Mr. S. M. **Milbourne** (Chairman and Managing Director, C. & W. Walker, Ltd.):—The descriptions of the various high-pressure plants at Malpas, Market Drayton and other places are most interesting and show the advantages of this type of storage to meet peak load requirements for small districts. The peak load periods may occur daily, or weekly in some districts where the Sunday cooking load is the heaviest consumption. In other cases, seasonal variations in gas output may occur, similar to those experienced at some seaside resorts during the summer months. These seasonal variations in some instances cause peak loads to become troublesome and I agree with Mr. Gill that high-pressure storage is often the best and most economical method of overcoming peak load difficulties. I should like to emphasize that in cases where the peak load is of short duration and occurs at infrequent intervals, pressure storage is particularly suitable, but as a form of main storage, large capacity pressure gasholders are generally not economical.

In instances where local conditions, such as bad ground, restricted area of site and protests of residents against a high structure obtain, it may be necessary to adopt high-pressure gasholders in preference to a low-pressure holder, regardless of the cost. There are some cases, however, where main storage has been satisfactorily augmented with high-pressure storage and the Tenbury, Stourport and Skipton installations are very good examples of such combinations.

I agree with Mr. Gill that the cost of installing pressure holders is less than for spirally guided holders. When comparing the cost of high and low-pressure storage, not only the initial outlay must be considered, but the cost of compression of the gas, attendance and maintenance, should also be taken into account. The desirability of having the compressors and the automatic governing gear in duplicate in cases where the compressing plant is in use over long periods, requires to be considered, and if such plant is duplicated, this adds greatly to the cost. When investigating schemes for high-pressure gasholders it is often surprising to find what a small amount of extra gas storage is actually required to tide over the peak load period in an outlying district. In some instances it will be found desirable to have one large and one small compressor, the large compressor being used for filling the container in short periods between heavy peak loads, while the small compressor can be used either to augment the effort of the large compressor, or to fill the container during light seasonal loads. In cases where the compressor is in use only for a few hours per week and there is practically no seasonal variation of the load, it is not considered necessary to have any stand-by plant.

I presume it is only in the case of Market Drayton and Tenbury that any stand-by compressing plant is installed, and I should be

very pleased if Mr. Gill could give us the benefit of his experience as to the desirability or otherwise of installing stand-by compressing plant, as pressure gasholders are so dependent upon these units.

I think Mr. Gill's remarks on welded steel pressure gasholders are of particular interest. The fact that engineering insurance companies are critical of large welded storage vessels and that some will not allow as high a joint efficiency for welded seams as they will for riveted joints, indicates that riveted vessels are preferable, and as Mr. Gill considers that it is essential for an engineering insurance company to inspect the materials and workmanship throughout the carrying out of the contract, I do not think there can be much doubt that a riveted holder is the best and safest proposition.

With regard to testing cylindrical containers by hydrostatic pressure, the insistence of some insurance companies on testing the completed vessel in this way adds greatly to the cost, as Mr. Gill has stated. The shell plating must be slightly thicker in order to resist the extra tension due to the head of water, while the framework inside the vessel must be capable of carrying the very considerable bending moments induced in the cylindrical sides. These bending moments, however, can be calculated within reasonable degrees of accuracy for any size of vessel, so that the water test does not present any difficulties from the designer's point of view.

So far as the spherical type of holder is concerned, the weight of steel is much less per unit volume of gas stored, than for the cylindrical container; but there is a number of disadvantages. A sphere requires a greater width of site than a cylindrical container; the height of a sphere is much greater than a horizontal cylindrical vessel; spheres are not so convenient to manufacture or erect, and inspection and painting are more difficult to carry out than in the case of a cylinder. Unless spherical containers are called for in appreciable numbers in this country, there is little possibility of standardising their contruction, whereas with cylindrical containers, standardisation is much simpler, as the capacity may be varied over a large range by merely increasing or diminishing the length of the vessel. These disadvantages, I think, explain to some extent why spherical gasholders have not been favoured in this country.

I have no hesitation in saying that the scope of development for high-pressure holders is a very wide one and I am sure that the valuable Paper which Mr. Gill has submitted to the Institution will be most helpful to those members who are contemplating this form of storage.

A Written Contribution

Mr. H. J. **Toogood** (Hampton) wrote:—This Paper has brought into prominence two generally neglected factors of fundamental importance: first, the very high relative capital cost of small-sized low-pressure gasholders; second, the consideration that in all modern processes convenience in use plays an increasingly important role in overall efficiency and, therefore, in the true economy of any particular plant. Realization of these truths by the Author has led to his advocacy of a prominent place for the high-pressure holder, in spite of its on-costs for compression, in the scheme of " things to come." Mr. Gill's Paper encourages in the younger men of the Gas Industry two constructive avenues of thought. Looking back, they will observe that the pioneer gasholders were collapsible, like bellows. They were followed by the water-tank, the single-lift, the multiple-lift, water lutes, and still larger and deeper water-tanks involving increasing costs for foundations. A movement to reduce holder installation costs led to the development of the waterless gasholder having a tar-seal and simpler foundations, and ultimately to the high-pressure gasholder. Up to a point, the history of gasholder development tends to repeat itself in reverse, and it is for our younger engineers to consider if the future lies with a re-application of the " concertina " principle to low-pressure storage. This system would, in short, combine the advantages of dry gas with waterless and tarless seals, cheap foundations, no compression on-costs, and freedom from fear of frost. The modern gas engineer has access to a wide range of materials, including plastics.

The Author's Reply

Mr. **Gill,** replying to the discussion, wrote:—Mr. Birks made several pertinent comments which are deserving of attention. He stated that the use of high-pressure holders was likely to be confined to the smaller sizes. That was originally my view, but having regard to recent experience, as for instance in Birmingham where a high-pressure holder of 470,000 cu.ft. capacity was being installed on the district to facilitate developments, and again in Long Beach, California, where four 500,000 cu.ft. high-pressure holders have lately gone to work, it suggests that there are going to be special reasons, perhaps fairly often, to induce engineers to use large high-pressure holders. Mr. Birks also pointed out that if a low-pressure holder and high-pressure holder be compared from the standpoint of locked up gas when empty the former type has an advantage. This is, of course, correct as there will be approximately 10,000 cu.ft. of unusable gas in a 250,000 cu.ft. low-pressure holder and 61,240 cu.ft. in a high-pressure holder of the same capacity for a working pressure of 60 lb. per sq. in. Actually in practice this is not a disadvantage of importance. Mr. Birks threw out the useful suggestion that there would be a number of advantages in constructing high-pressure holders to withstand a pressure as high as 16 atmospheres. This is quite true and it is to be hoped that there will be actual developments in this direction.

Mr. G. C. Pearson gave the meeting advance information of the large—nearly 500,000 cu.ft.—high-pressure holder now being installed on the district in Birmingham. This is breaking new ground and may be the forerunner of large high-pressure district holders. It is noteworthy that this holder is very long at 200 ft. and proportionately small in diameter at 25 ft. This is likely to be the tendency in future as there are good reasons for it, due mainly to thinner plates being required and therefore lower cost of construction with all sizes of high-pressure vessels.

Mr. Belton's contribution was particularly complete and useful to all those who are or will be considering the use of high-pressure holders and compressing plant on the district. It is clear from what he said that the scope for the use of this system on the district is likely to be considerable in the future.

Mr. McNair made it clear that the large 250,000 cu.ft. high-pressure holder installed many years ago had been entirely successful. Mr. Milbourne's comments were very useful and were generally in accord with the Author's own views. He commented on the fact that of the various high-pressure installations in small gas-works, as described by the Author, only two works had standby compressing plant and enquired whether standby plant had been found necessary in practice.

In the two cases, *i.e.*, the Market Drayton and Tenbury gas-works, to which Mr. Milbourne specifically referred, larger compressors had to be installed when the high-pressure storage capacity was increased. These were not installed as a standby. The Author's general experience in small works is that it is not economically practical to have anything like complete standby plant for all units. Some risk must be run on account of expense in such works, though by keeping fairly complete spares of working parts the risk can be largely eliminated. Nevertheless, on no occasion has the compressing plant failed to operate when required at any of the works described in the Paper.

The Author does not altogether agree with Mr. Milbourne on the question of riveted versus welded high-pressure holders. He considers that an engineering insurance company should be engaged to inspect the materials and workmanship throughout the carrying out of the contract whether it be a riveted or welded vessel, and hopes that future developments will be in the direction of welded construction, and certainly in cases where it is practicable and not unreasonably expensive to carry out a hydraulic test.

In this direction much depends upon the diameter of the vessel. If large in diameter then the water test will be expensive, but not so if the vessel be small in diameter.

While the Author agrees generally with Mr. Milbourne respecting his comments on the disadvantages of the spherical type of holder, nevertheless the small weight of steel necessary for these holders in comparison with those of cylindrical construction is an advantage which in the Author's opinion should not lightly be discarded by gas and constructional engineers.

Finally, the Author hopes that the outstanding work done by the American constructional engineers who built the four large 500,000 cu.ft. high pressure welded holders for the Long Beach Gas Company of California will not be overlooked by engineers in this country, particularly as these vessels were put into service without hydrostatic test after a meticulously careful test step by step by the new Magnaflux system.

Distribution of Building Materials

Procedure for obtaining certain building materials have been simplified as from Aug. 1. " Permits to purchase " plate glass are no longer required. Plate glass, however, comes within the scope of the preference scheme for the distribution of building materials and components against W.B.A. priority symbols.

" Permits to purchase " plasterboard are required only in the London Civil Defence Region. Outside this Region no " permits to purchase " are required, but plasterboard comes within the scope of the preference scheme.

" Permits to purchase " asbestos cement products and slates are required only in the London Civil Defence Region. Outside this Region no " permits to purchase " are required, but these articles remain within the scope of the preference scheme.

While the procedure for obtaining these four materials has been simplified it is not to be assumed that the supply position has improved. For example, slate production is still less than 50% of the pre-war figure and restrictions on the use of slates must continue to be operative. It should particularly be borne in mind that slates of 13 in. or more in length may be used only as replacements and thay may not be used where a damaged roof has had to be completely stripped. Those who wish to obtain W.B.A. priority for plate glass and plasterboard, which materials are not at present included on the application forms for W.B.A. priority, should write " plate glass " and/or " plasterboard " in the blank spaces in the first column of form B.M.5.

Delivery of the materials mentioned will be made to holders of W.B.A. priority before non-priority orders are met.

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Aerated Burners of High Stability*—III.

By L. T. MINCHIN, B.Sc., M.Inst.Gas E.

Other Useful Features

IN the second article of this series the means necessary to make an injector "self-extinguishing" were discussed. The flame which is forced to leave the injector in this way may either be extinguished completely, or it may go forward and light the gas on the flame ports. To describe this latter property we have coined the term "perignitable,"† and it is a feature which has obvious applications in appliances which are otherwise difficult to light.

The Perignitable Burner

The flame can only travel from the air port to the burner head through a combustible mixture, and it is therefore an essential that the burner tube shall contain air and gas *before* the flame is applied. This means that the flame must be applied after the gas it turned on and that the aeration must be at least as high as the limit of inflammability.

However, even the flame which runs forward itself produces products of combustion which follow it out of the flame port. If they are non-combustible, and sufficiently voluminous, they may extinguish the flame even after it has formed on the flame port. It therefore appears that for a burner to be satisfactorily perignitable:

(*a*) flame must leave injector without extinction;
(*b*) flame must travel through burner without extinction;
(*c*) flame must be able to penetrate flame ports;
(*d*) flame, having reached the combustion chamber, must not be extinguished by the products of combustion which follow it.

As a result of a considerable amount of experimental work, empirical rules for designing these burners have been developed, but the theoretical understanding of the process—especially that part of it which takes place in the injector and burner tube—is very imperfect.

Considering the above four points seriatim, the following summarises our present knowledge:

(*a*) All self-extinguishing injectors are not suitable; the multi-hole type, for instance, appears to cause the flame to be extinguished completely. On the other hand, the double injector, the spinning jet, and the simple burner types are satisfactory.

(*b*) The extinction of flame in the burner tube, when it occurs, may be connected with too high a degree of turbulence, but little definite information is known of this. Much more readily understood, however, is the extinction which may occur as a result of too low an air-gas ratio, for the air-gas mixture will then no longer support flame. This limit is, for 500 C.V. gas, air air-gas ratio of 2 : 1 and it is obvious that this value must be exceeded if one is to be certain of flame travelling through the burner. Using the "simple burner" arrangement, a certain length of parallel throat always seems to be necessary. This may, however, only be a reflection of the need for an adequate aeration.

(*c*) The penetration of the flame ports by the flame is found to depend both on the size of the holes and their distance apart. For instance, if solitary holes or holes ½ in. or more apart between centres are to be used, their diameter must be at least .30 in., but for holes ¼ in. or less apart 0.10 in. diameter is all that is needed.

(*d*) If the aeration is not very high, or the burner tube fairly short, the compliance with the conditions set out in (*a*), (*b*) and (*c*) above will produce a satisfactory perignitable burner. With a long-shanked and highly aerated burner, such as might be employed for a muffle furnace, however, there is a likelihood that the flames will form momentarily and then be blown out by their own products of combustion. To overcome this a number of devices have been suggested in a G.L.C. patent specification (14). The simplest of these is the provision of a pilot which is tapped off the main supply to the burner and remains turned on and alight only so long as the burner is alight. It can be of robust construction and its gas rate is not important. It is lit by the first flash of flame coming through the flame ports and relights the mixture issuing after the products of combustion. Another method which is only practicable with large burners, is to curve the burner tube back on itself so that the first flame port is close to the last. The first port is then emitting air-gas mixture by the time the flash reaches the last, and is thereby ignited.

The perignitable burner has been successfully applied in a preliminary test to the domestic wash copper. In this case the extra precautions mentioned in Section (*d*) were unnecessary as the degree of aeration required was not particularly high. The self-extinguishing injector was constructed in accordance with the principles set out in the previous article and the only other alteration necessary was the provision of one large extra flame port drilled in the burner ring to ensure that the flame would pass through into the combustion space.

In the case of industrial appliances the combustion space is often almost completely enclosed and some danger might be associated with a burner which it was necessary to light after the gas was turned on. The operator might be slow in applying the light and cause an explosion of the gases in the combustion space. This difficulty may conveniently be overcome by attaching a short pilot to the gas cock, so that the pilot flame swings over the air port and comes to rest just beyond it, having sent the flame forward to the burner head. The pilot can then be turned out. Alternatively, a small perignitable burner may be constructed to serve as a pilot to light the main burners of the apparatus.

Although the perignitable burner has scarcely emerged from the experimental stage, enough cases of its utilization have been reported to encourage the prospect of fairly widespread use in the future.

Flame-proof Burner Heads

It has been known at least since the time of Sir Humphrey Davy that a flame will not pass through a gauze or perforated plate if the holes are sufficiently small. Indeed, burner heads having this property appear to have been essential if an aerated flame was to have been used until Bunsen designed his famous burner in 1855 (15). This burner seems, in fact, to have been such a striking advance because it maintained such a high velocity in the burner tube that a flame-proof head was rendered unnecessary.

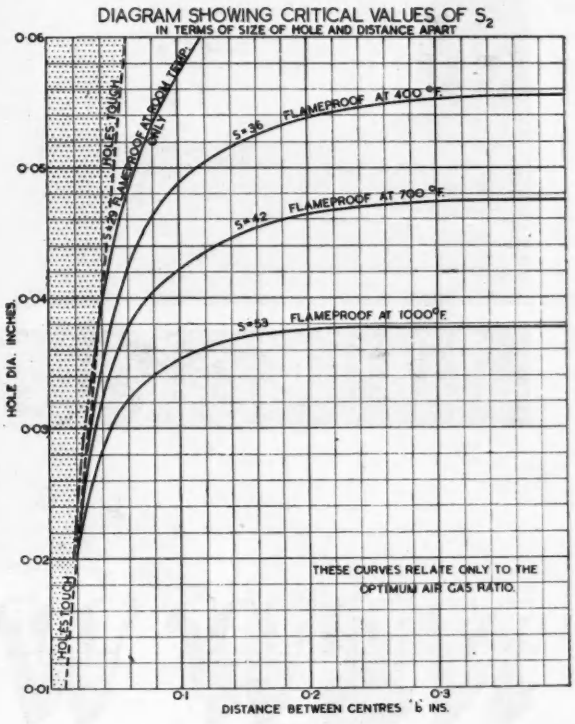
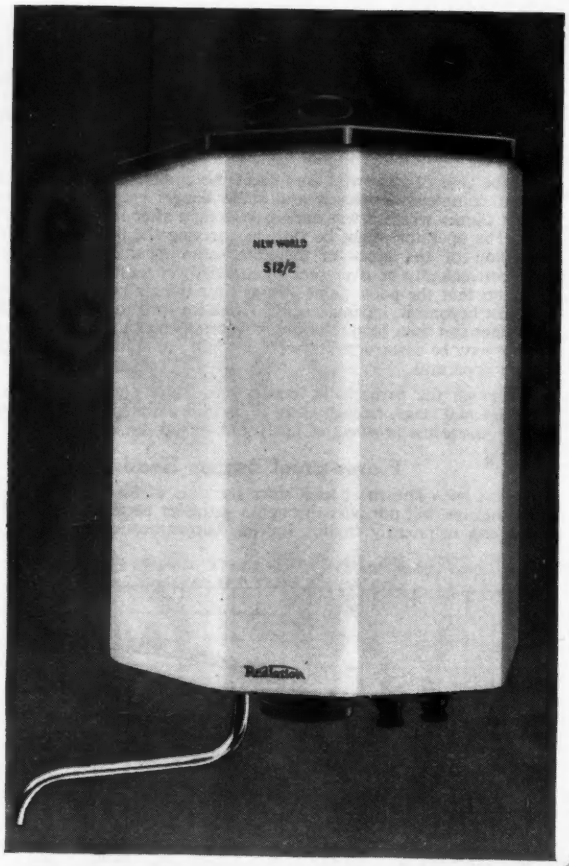


Fig. 12.

Probably the disadvantages which Bunsen was so glad to have overcome were (*a*) liability to blockage and corrosion, and (b) the low efflux velocity associated with fine gauzes, especially in the very wide burner tubes then employed. Both these effects, however, can be minimized if the aperatures are made as large as possible and if the material of which the plate is made is non-corrosive under flame conditions. Until fairly recently, the critical size of hole was not

* Communicated by the Watson House Research Department of the Gas Light and Coke Company.

† A work suggested by Mr. E. E. Blandon of Watson House.



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known, but a pre-war investigation at Watson House [16] settled this, at least so far as the Gas Light and Coke Company's gas is concerned. It was then found that the "safety number" or degree of flame-proofness could be represented by a formular:—

$$S = \frac{1}{r} - \frac{2r}{b^2}$$

where r is the radius of hole and b is the distance of the holes apart between centres.

If b and r were measured in inches, it was found

S = 50 in.$^{-1}$ or over. Flame will not pass at 540° C. (1,000° F.)
S = 42 „ „ „ „ „ „ „ „ 370° F. (700° F.)
S = 31 „ „ „ „ „ „ „ „ 40° F. (104° F.)

the air gas ratio in each case being that corresponding to the maximum flame velocity.

These facts are summarized in Fig. 12, which is taken from the original paper. As an example, a plate having holes 0.036 in. in diameter and 0.058 in. apart (between centres) has a safety number of 45 and is consequently flame-proof up to at least 370° C. If it was desired to make if flame-proof at 1,000° F. the diameter would have to be reduced to 0.031 in. or the distance apart increased to 0.12 in. The thickness of the plate has very little effect on this property.

The most suitable perforation pattern is one which is not easily punched in a hard metal, and it is a little difficult to obtain a material which is soft enough to be punched but at the same time sufficiently heat and corrosion-resistant to withstand the conditions. Promising results, however, have been obtained with 32 gauge stainless steel. Moulded clay discs can also give satisfactory results, but tend to overheat. An alternative which is sometimes useful is a metal tube furnished with saw-cuts, which should be not more than 1 mm. wide.

The use of a flame-proof head of this type should make impossible the lighting-back of the burner through the burner tube, and this is, in many cases, very desirable. The bunsen burner on the laboratory bench, for example, is not likely to be accidentally ignited at the air port. It is however very prone to lighting back when turned down too quickly, and as the chemist will often want to turn his burner down quickly it is a great advantage if the burner can be fitted with a flame-proof head. Such a burner can be turned from full-on to a faint glimmer with a flick of the fingers. Evidently there would not be much advantage in incorporating a self-extinguishing injector in such a burner, since at very low turn-down a flame would probably be stable on the injector.

The High Aeration Burner

With a low pressure burner of usual pattern it is difficult to reach an air-gas ratio of much more than 2.5 : 1, which in the case of 500 C.V. gas is about 60% of the air required for combustion. Further increase can usually be brought about by increasing the area of flame port, but this lowers the average velocity of efflux so much that the flame rapidly becomes unstable. If, however, a flame proof burner head is used this objection does not apply and it becomes possible to work with a much lower velocity of efflux quite safely. On this principle experimental burners have been made up, both here [17] and in America [18] which have burned at a ratio of 4 : 1 or even as high as 7 : 1. This gives rise to fresh difficulties in the overheating of the burner head, and it cannot be said at the moment that ratios as high as this are practicable. There are however burners on the market at present for heating moulding platens which normally work at a ratio of 3.4 : 1 (80% of theoretical) by virtue of saw-cut flame ports of 1 mm. width or less. The advantage of this increase when a burner is working in a confined space is obvious; the amount of secondary air is reduced from 40% to 20% of the total air requirements, and in many cases the need for more expensive air-blast equipment is obviated.

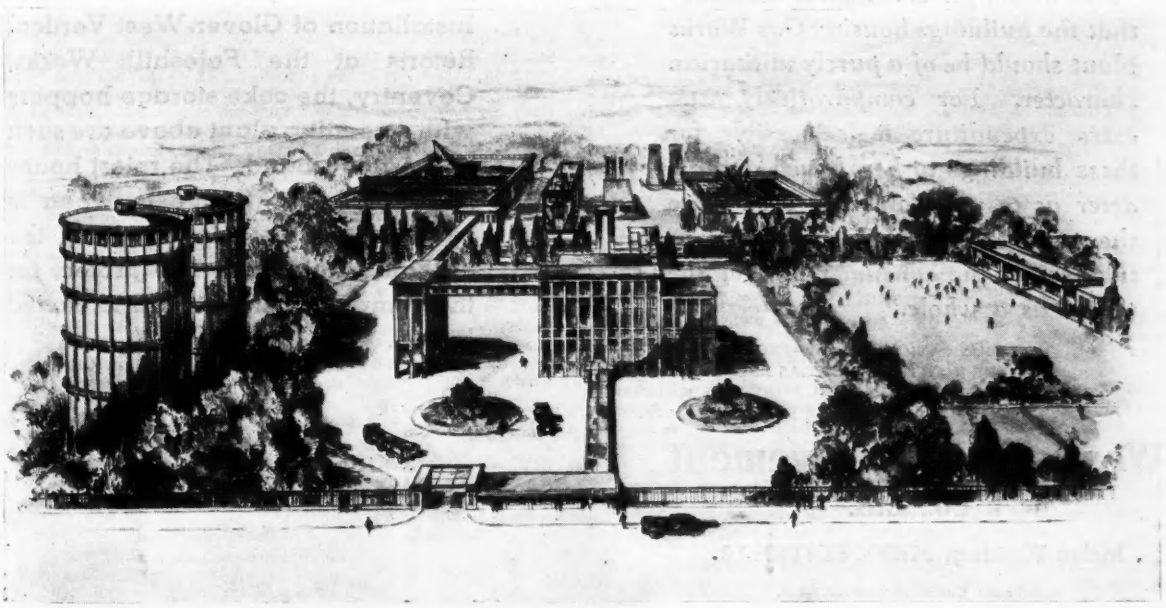
Conclusion

In this and the two preceding articles attention has been drawn to a number of possible ways in which the aerated burner can be improved so as to give greater stability and at the same time higher aeration. Not all these suggestions are practicable at the same time; in fact, the flame-proof head and the perignitible burner are mutually exclusive. Used in appropriate circumstances, however, there is no reason why these suggestions should not be of considerable benefit to the appliance designer and ultimately to the general public which uses gas appliances in factory and in home.

Literature References

[14] G.L.C.C., Minchin and Roberson. B.P. 514, 207.
[15] Chandler. "Outline of History of Lighting by Gas," pp. 179-181. (S. Met. Gas Co., 1936.)
[16] Minchin. Gas J. 226, 925-928 (1939).
[17] G.L.C.C. Minchin, Harrison and Dunning. B.P. 540, 384.
[18] "Temperature as a Factor in the Design of Aerated Burners." A.G.A. Res. Bull. No. 34 (Dec., 1944).

Gas-works of the Future



The North Western District of the British Gas Council was asked to supply a picture showing a modern gas-works set in rural surroundings and Mr. W. S. Hubbard, Engineer of the Liverpool Gas Company, prepared a plan showing that the future modern gas-works can be adapted to suit most rural surroundings. The artist's impression from Mr. Hubbard's plan shows a manufacturing station capable of producing up to 10 mill. cu.ft. per day.

Mr. Hubbard says that such a layout can be made possible if special attention is paid to intensive mechanization and the centralization of ancillary processes usually associated with gas production.

While it is already known that the processing of coal in gas-works is still the most economical method of treating the nation's rapidly depleting resources, such a layout as is shown in the plan would lead to ever higher efficiencies. It would appear, therefore, that the gas worker of the future wearing his white coat, and collar and tie, will find his operator's task is made congenial by introducing automatic control wherever possible. Instrumentation and an efficient ventilation system would follow, with canteen and welfare facilities.

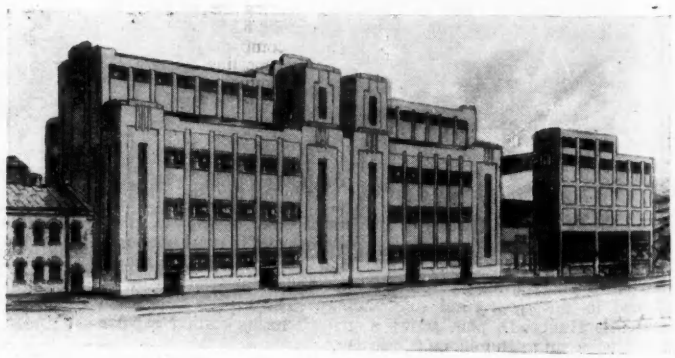
In fact, the gas-works of the future will be so attractive that there will be no lack of aspirants to the congenial job of gas worker.

GLOVER-WEST *Vertical Retorts at* COVENTRY

"It is no longer considered necessary that the buildings housing Gas Works plant should be of a purely utilitarian character. For comparatively little extra expenditure it is possible for these buildings to be of such a character as to maintain and even raise the prestige of the Gas Industry in the eyes of the consumer and of the public as a whole."

COMMUNICATION No. 230—PROCEEDINGS OF THE INSTITUTION OF GAS ENGINEERS, 1939-40.

In this photograph of the fourth Installation of Glover-West Vertical Retorts at the Foleshill Works, Coventry, the coke storage hoppers with screening plant above are seen in the foreground. The retort house lies to the left. Space between is reserved for the duplication of the carbonizing plant. The project for the complete installation is sketched below.



West's Gas Improvement Co., Ltd.

Miles Platting, MANCHESTER 10.

Telephone: Collyhurst 2961-2-3-4-5.
Telegrams: Stoker, Manchester.

London Office:
COLUMBIA HOUSE, ALDWYCH, W.C.2.

Telephone: Holborn 4108-9.
Telegrams: WESGASCO, ESTRAND.

Gas Undertakings' Results

Boston Gas Light and Coke Company.—At the annual meeting the Directors' report revealed a net profit on the year of £3,334 and recommended the payment of a further dividend on the old Ordinary shares of £4 17s. 9d.%, making a total of £9 2s. 9d.% for the year, and on the new Ordinary shares of £4 0s. 6d., making £7 10s. 6d. for the year. The sale of gas during the year realized £52,778, an increase of £9,007 on the previous year, largely due to an increase in the price of gas of 1d. per therm in September. The income from the sale of residual products on the other hand showed a decrease of £584 at £32,296. The number of gas cookers in use showed an increase of 163 during the year, bringing the total to 6,012 and the number of meters in use at the end of the year was 7,939, an increase of 24. Sales of gas showed an increase of 5.5% when compared with last year, in spite of the fact that several large war-time loads ceased at the end of hostilities. An allowance of £700, free of income tax, was made to the Directors.

Bradford Gas Department.—The financial report for the year ended March 31 shows a net profit of £26,992. The total income was £750,261, an increase of £45,699, but expenditure rose to £635,939, an increase of £48,945. The number of consumers increased from 80,871 to 81,068. The net debt on the undertaking was reduced to £432,502 by the end of March, and the Departmental reserves were increased to £205,078.

Hawick Gas Company.—The Directors of Hawick Gas Company have decided to go on developing the company both technically and financially, although they are left in doubt as to the Government's intentions to nationalize the Industry. Mr. J. Boyd Sime, who presided at the annual general meeting of shareholders in the Burgh Chambers, said that they have decided upon this policy, so that if they must hand over their charge to the nation, the public interests will not suffer. In doing this they feel entitled to expect a square deal in the way of financial compensation. The annual report stated that gas sold during the past year had increased to 173,485,000 cu.ft. from 164,720,000 cu.ft. in the previous year. Profit for the year is given as £1,897, and a dividend of 5%, tax free, is declared. The balance carried forward is £6,393. The introduction of the six-shift week for gas workers and various general increases has made a substantial increase in the wage bill during thepast year. The recent advance in railway rates will effect the cost of coal, but if sales of gas continue to increase, and the by-product business is favourable, it will not be necessary to apply for permission to increase the price of gas.

Lochgelly Gas Company.—At the 61st annual meeting of shareholders Mr. Alex Westwater, J.P., stated that the sale of gas has increased over the year by 13%. From a net carry forward the directors recommended a dividend of 6%, less tax. Mr. Westwater pointed out that the average dividend, less tax, for the past yen years was 3%, the directors having upheld the policy of ploughing back profits, with the result that the works has been greatly extended and improved.

Northampton Gaslight Company.—Gas sales for the year ended June 30 showed an increase of 176,192 therms, or 2.2% over the previous year, and the Company received an average of 11.62d. for each therm sold, as against 9.31d. in the last complete pre-war year. The price charged to consumers has thus risen by 25%, against increases of 83% in coal costs and 51% in wages over the same period. The balance carried to net revenue was £27,875, against £24,655. A final dividend of 2½%, making 5% for the year, absorbs £7,257, leaving a balance of £9,245 to be carried forward, against £8,374 brought in. The Directors' report records that a new coke storage and screening plant with the necessary coke conveyors has been installed and is now in operation.

Stirling Gaslight Company.—Sales of gas during the year ended May 15 attained a record total of 369 mill. cu.ft., 8.8% higher than the previous year, and an increase of 45.6% compared with 1939. Mr. James F. Millar, Chairman, at the general meeting on July 30 said that during the war years the total expenditure increased by 97%, and in the past year, despite considerably increased production costs, the price of gas still remained at pre-war levels. Net revenue had reached £100,000, representing an increase of 100% since 1937. Unprecedented demand, together with the very considerable house-building development in the area, had indicated the necessity for increasing the productive capacity of the works, and the Directors had decided to seek authority to duplicate the present vertical retort installation as quickly as possible. Fourteen years ago they were faced with the problem of modernizing the carbonizing plant, and adopted the Glover-West system. The retort plant, which at that time had a capacity of 50% more than requirement, had produced excellent results year after year, and had far exceeded the guaranteed life of the retorts, with considerable financial benefit to the Company. They had, therefore, no hesitation in returning to the same company to formulate plans for extensions to the carbonizing and fuel handling plant. Since 1932 the consumption of gas had increased by 72.8%. Air Ministry gas purifiers had been purchased during the year and had been connected as an extension to the existing gas purification plant. Authority had been given by the Ministry of Fuel and Power for new water-cooled gas condensers, and an order had been placed for delivery early next year. Main-laying was begun in the Cornton district during the year and they were proceeding with the development of gas distribution system in all parts of the area at considerable capital expense. Referring to nationalization, Mr. Millar said this had created a feeling of uncertainty tending to impede a progressive outlook and seriously inconvenienced the natural development of the Industry. Every effort would be made by the Board to protest the legitimate interests of the shareholders. Many consumers were unaware of the statutory obligations of the Company which at present protected the consumer and public alike, and which would not obtain under Government control. Quality and pressure of their commodity was rigidly enforced, and the price of gas to the public regulated any profit which might be available. There was no doubt that the undertaking had prospered under private enterprise in accordance with statutory control, but that prosperity had also been passed on to consumers.

Swadlincote Gas Department :—The annual accounts of the gas undertaking for the year ended March 31, 1946, showed that the undertaking incurred a gross loss of £1,644 as against a gross profit of £1,748 in the previous year, and that after making provision for other items of expenditure the net loss amounted to £4,281, representing a rate of approximately 1s. 1d. in the £. It was recommended that application be made to the Ministry of Fuel and Power for authority to increase the price of gas by 3½d. per therm.

Wellingborough Gas Light Company.—Sales of 2,022,637 therms of gas in the year ended June 30 brought in £91,823, compared with £85,941 from 2,039,307 therms in the previous year. The balance carried to net revenue account was £13,977, against £13,274. An interim dividend was paid in March, and the Directors recommend final dividends, making 7½% for the year on the Original shares, and 6% on the Additional shares, less tax, the same as for the previous year.

Dividends

Commercial Gas Company.—The Directors of the Commercial Gas Company have declared on the 4% Redeemable Preference stock 1960/63 a dividend for the half-year to June 30, 1946, at the rate of 4% per annum, less tax. On the Ordinary stock an interim dividend on account of the year ending Dec. 31, 1946, of 1½%, less tax.

Gas Light and Coke Company.—The Directors have declared dividends for the half-year ended June 30, 1946, at standard rates on the Preference and Maximum stocks and on the Ordinary stock at the rate of 5% per annum (2½% actual), all subject to tax.

Newcastle upon Tyne and Gateshead Gas Company.—The Directors declared interim dividend 2½% on the Ordinary stock (the same rate as last year).

Romford Gas Company.—The Directors have declared an interim dividend of 2½% actual, less tax, on the Ordinary stock on account of the year ending Dec. 31 next.

South Metropolitan Gas Company.—The Directors have declared an interim dividend of 2% actual on the Ordinary stock for the six months ended June 30 (compared with 1½% last year).

Tottenham and District Gas Company.—At a recent meeting of Directors, interim dividends were declared for the year ended Dec. 31 at the rate of Ordinary stock 2½% actual, less tax at 9s. in the £, on account of the year ending Dec. 31, 1946.

Wandsworth & District Gas Co.—The Directors sanctioned payment of dividends for the half-year ended June 30 last at the following rates : On the 4% Preference stock, 4% per annum; on the Consolidated stock, 5% per annum. Less tax.

Watford and St. Albans Gas Company.—The Directors declared an interim dividend of 2½% on the Ordinary stock (the same), less tax.

Woking District Gas Company.—The Directors sanctioned payment of dividends for the half-year ended June 30 last at " A " Ordinary stock £11% per annum, " B " Ordinary stock £7 14s.% per annum, all less tax.

A loss to the Local Ratepayers of £14,700 a year was forecast at the meeting of Chesterfield Town Council on July 30 if the Corporation's gas undertaking is nationalized.